

Issues to consider in abandoned mine surveys

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1. Even if a mine is considered safe for performing an internal survey, external surveys should still be conducted, especially if no significant bat sign was discovered underground and/or if the mine may be closed in a non-bat compatible manner. Many bats roost in crevices and are not visible by an internal survey, and their guano may remain in the crevices. In the warm season, an evening exit survey will reveal bat use, sometimes when no bats have been seen via an internal survey. In the winter the bats in crevices may be overlooked. Therefore, no permanent closures should be done in the winter.
2. For exit surveys, red lights should not be used. Dr. Uwe Schmidt presented a paper at the IBRC in Brasilia showing that Microchiropteran bats exhibit physiological responses to colors. We have seen outflights of *Corynorhinus* and *Macrotus* stop when lights with red filters are turned on. More controlled experiments need to be conducted. In the meantime, only night vision equipment and/or IR cameras (both with auxiliary IR light sources) or thermal imaging should be used for external mine surveys. If meaningful surveys are to be performed, the appropriate equipment should be employed. This also means that back-lighting a mine is not effective, especially for species that fly late such as *Corynorhinus*.
3. Moon phase may affect bat outflight for some bat species. We have data from paired *Macrotus* exit counts the week before the full moon, and the week after full moon showing a two to tenfold increase in the exiting bats when no moon is present. We have not looked at the data on other species yet. Until more data is available, moon phase should be taken into account when comparing population counts between years, especially when the effects of gating are being assessed.
4. In excluding bats from mines prior to hard closure, the use of materials such as smoke bombs to drive bats out should be used cautiously. More controlled experiments should be conducted. Smoke bombs and explosive devices can drive bats further underground, especially in deep hazardous mines that cannot be explored entirely. Outflight counts need to be conducted the night immediately prior to exclusion, and then the mine watched during exclusion, so that all the bats are seen to exit.

5. For many desert bats, open water sources may not be necessary. Maternity colonies of *Macrotus* and *Corynorhinus* in the California desert are found 25 miles from water sources. When considering if a mine might be bat habitat, mines close to water sources are often better habitat, but the lack of water does not mean that a mine is not good habitat.
6. When mines are to closed in a non-bat compatible manner (either for hazard abatement or renewed mining), surveys need to be conducted immediately prior to closure, and bats excluded after exiting in the evening. Surveys conducted in another season or another year may be invalid by the time the bats need to be excluded. No closures should be conducted in the winter or during inclement weather when bats won't exit the mine.
7. Acoustic survey techniques should be used cautiously and viewed as providing supplemental information for many mine-roosting bats. *Corynorhinus* make such faint signals that they are rarely detected. *Macrotus* and *Antrozous* may not echolocate at all when moonlight is available for visual navigation. If no (or very few signals) are recorded near a mine, it is not an indication that the mine is without bats. Always remember that absence of evidence is not evidence of absence.